Interface with Learning Sciences

From its earliest programming, COSEE has included the design of learning environments and research-based development of programs and learning resources as central to the missions of the Network and individual Centers. Learning sciences is a term that has gained prominence in the last two decades as a way of describing a field of study that draws on education, psychology, sociology, cultural anthropology, computer sciences, and other fields to support the design of learning environments and research on teaching and learning within those environments. For the purposes of this summary of the ways COSEE has interfaced with learning sciences, learning scientists are defined as *university faculty in education, psychology, or sociology of learning or other departments or agency staff whose primary responsibilities include research on teaching and learning or the design of learning environments based on that research*. Learning sciences and learning scientists have played a major role throughout the COSEE network since its inception.

COSEE learning sciences efforts can be divided into four general areas:

1. Including learning scientists in leadership and management positions.
2. Partnering with learning scientists for designing learning environments and program delivery within those environments.
3. Supporting research efforts on learning and teaching.
4. Disseminating findings.

Including learning scientists in leadership and management positions

COSEE Centers have supported the collaborative work of educators, ocean scientists, and learning scientists at every level. Perhaps the most obvious from a structural perspective is the inclusion of learning scientists at the level of principal investigator or senior personnel in many Centers. COSEE Pacific Partnerships, for example, includes two learning scientists and two ocean scientists as PIs. COSEE PIs working in the learning sciences represent university extension faculty as well as university departments of Science and Math Education, Resource Management, Environmental Education, Curriculum, and Teaching and Learning. In addition, most of the external evaluators working with COSEE Centers are trained as learning scientists or are working currently in learning sciences positions.

Partnering with learning scientists for designing learning environments and program delivery within those environments

A significant focus of learning sciences research is the development of innovative learning environments, especially computer-based and virtual learning environments. COSEE PIs and senior personnel, working with university faculty, have developed multiple innovative, research-based collaborative on-line and face-to-face learning environments. COOL Classroom is an online problem-based learning environment that was developed by COSEE Networked Ocean World. COOL Classroom itself is based on a learning sciences model for integrating knowledge, assessment, and community. COSEE West and COSEE Great Lakes, among others, have partnered with learning scientists at the College of Exploration to create on-line workshops for students, professional educators, and scientists. COSEE Ocean Systems has similarly partnered

with learning scientists, computer scientists, and ocean scientists to create on-line learning tools like the Ocean-Climate Interactive website and Concept Map Builder. COSEE California's Communicating Ocean Sciences and Communicating Ocean Sciences to Informal Audiences classes were also developed as partnerships among ocean scientists, learning scientists, and educators who worked iteratively to design both classes so that they model and teach ocean sciences communication techniques based on findings from learning sciences research broadly. These classes are now offered at over 25 different universities nationally and internationally.

Supporting research efforts on learning and teaching

Design-based research is a hallmark of learning sciences. COSEE Centers across the Network have used iterative, design-based research methodologies to develop learning environments, documenting how and why they work, and in the process contributing to our understanding of the cognitive and social processes that support learning ocean sciences for children and adults in schools and in public, informal settings. In addition to learning sciences research carried out by project personnel and PIs, such as the work of COSEE Networked Ocean World described above, COSEE Centers have supported faculty, graduate students, and post doctoral fellows in their research on learning and teaching. COSEE Great Lakes and COSEE Pacific Partnerships, for example, have supported the work of multiple graduate students on grants for research on teaching and learning and as graduate research assistants working closely with project PIs. Past and on-going graduate student research has examined on-line learning environments; the philosophical orientation to teaching, labs, and homework in the science classroom; the value of scientist engagement in adult education; perspectives of volunteers on learning and teaching ocean sciences in aquariums and science centers; and the impact of professional development in communication for ocean scientists.

Dissemination of findings

While much of the learning sciences research carried out by COSEE Network members is still ongoing, Centers have begun to disseminate early findings through conference presentations and publications. COSEE members present annually at a wide range of professional conferences attended by learning scientists including the American Educational Research Association (AERA), the National Association of Research on Science Teaching (NARST), the National Science Teachers Association (NSTA), the North American Association of Environmental Education (NAAEE), and the International Conference on Computer-Based Learning in Science.

Perhaps more importantly, COSEE Centers have worked to create opportunities to disseminate the design of research-based learning environments throughout the Network. Webinars such as those hosted by COSEE Networked Ocean World, jointly sponsored workshops to train others in the Network to use tools created by COSEE Ocean Systems, and the training to implement COSEE California Communicating Ocean Sciences curriculum share findings from design-based learning sciences research across the Network, while encouraging participants from outside the COSEE Network to use some of the same techniques and tools in their own work.